

FACTSHEET

Hill Country Futures: Lime use

April 2022

Applying lime to New Zealand hill country is necessary to neutralise the naturally acidic (pH 4.8-5.2) state of this land class. Acidity is undesirable, limiting legume establishment and growth.

Key messages

- Applying lime to hill country soils helps neutralise their naturally occurring acidic state.
- As a rule of thumb, the more profitable the farm, the higher the optimal soil pH.

Why is New Zealand hill country acidic?

Soil and plant biological processes – such as organic matter accumulation, mineralisation of organic matter to nitrate N, and clover nitrogen fixation – all contribute to acidify the soil.

Plant growth benefits of applying lime

Liming soils – thus increasing soil pH – benefits plant growth by:

- Decreasing the soil aluminium and manganese toxicity. These restrict root growth and, therefore, a plant's ability to uptake moisture, exchange gases and nutrients and form N-fixing nodules.
- Improving the environment for microorganisms and earthworms to cycle soil organic matter.

- Increasing the availability of molybdenum, which is required by the rhizobium associated with legumes for nitrogen fixation.
- Improving soil moisture, by reducing the severity of dry hydrophobic (water repellent) soil conditions – as found on the east coast of both islands.
- Increasing the availability of phosphorus (P) on some drier sedimentary soils (found on the east coast of both islands) and recent Northland soils.

Cost vs benefit

Liming hill country can be expensive, because of transport and aerial application costs. It is therefore worth considering which areas of your property will yield the greatest return on the investment.

Determining whether it is economically viable to apply lime to hill country depends on three factors:

1) Farm profitability

Applying lime is more economically justifiable, as gross margin increases. This is because the value of the increased pasture production (generated by applying lime) is only realised if it is ultimately converted into animal production.

Stocking rate (SU/ha)	Associated gross margin (\$/ha)	Optimum soil pH	Maintenance lime rate
<6	Less than \$750	5.0-5.2	1 t/ha every 10-15 years
6-10	\$750-\$1000	5.4-5.6	1 t/ha every 5-10 years
10-12	>\$1000	5.7-5.9	1 t/ha every 3-5 years

2) Legume cover

The pasture sward needs an average of at least 10% legume content. It is not economic to lime swards dominated by low fertility species, such as browntop.

This table shows results from a Central Hawke's Bay dry hill country (annual rainfall of 800 mm) trial. There is significantly more benefit from applying lime to south, rather than north, aspects – simply because there is more legume present and this responds better to lime than hill country grasses.

Aspect/slope/ initial pH	Increase in legume cover (%)	Increase in pasture yield (%)	Recommended lime programme for typical farm
North steep/5.4	10	9	1 t/ha when soil pH drops below 5.2
North /easy/5.6	8	5	1 t/ha when soil pH drops below 5.2
South/steep/5.4	34	23	1 t/ha to maintain at pH 5.4-5.6
South/easy/5.4	24	19	1 t/ha to maintain at pH 5.4-5.6

3) pH and Olsen P levels

Pasture dry matter response to lime increases as pH decreases.

If soil pH is less than 5.5, your soil Olsen P levels need to be >15 to warrant applying lime. If Olsen P levels are lower (<15), apply P (and sulphur (S)), because it will give you a greater production response than lime.

If soil pH is greater than 5.5, also opt for P (and S) ahead of lime, regardless of your Olsen P levels.

pH status	Olsen P < 15	Olsen P > 15
pH < 5.5	Apply P and S	Apply lime
pH > 5.5	Apply P and S	Apply P and S

Conclusion

To gain the benefits from the use of lime:

- Increased pasture growth needs to be converted into increased animal production
- Sufficient legume content must be present in the sward to maximise pasture growth
- Check pH and Olsen P levels, as it may be more effective for pasture growth to apply P and S before considering the use of lime.

Further reading

This factsheet is part of the Hill Country Futures soil and fertiliser series. The full series can be found at www.hillcountryfutures.co.nz/resources/soil-and-fertiliser-series

“Lime use on New Zealand pastoral farms” booklet, produced the Fertiliser Association of New Zealand booklet. Download at: <http://www.fertiliser.org.nz/includes/download.ashx?ID=154152>

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